Department of Homeland Security

Analysis Report

Responder Assessment and Validation of User Equipment (RAVUE)

Non-Motorized Extrication Devices

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Table of Contents

List of Figures, Tables, and Charts

1. OVERVIEW

A. SAVER/ RAVUE DISCLAIMER STATEMENT

This project was funded by the Office for Domestic Preparedness, Systems Support Division (ODP SSD), U.S. Department of Homeland Security.

Opinions or points of view expressed in the assessment portion of this analysis report are those of the Focus Group participants and the assessment evaluators and do not necessarily represent the view or official position of the Department of Homeland Security, Office for Domestic Preparedness, Systems Support Division or the Center for Domestic Preparedness.

B. SAVER/RAVUE GOALS AND OBJECTIVES

The Office for Domestic Preparedness has developed a technical assistance program to help ensure that Emergency Responder communities are properly equipped and have adequate information resources. The System Assessment and Validation for Emergency Responders (SAVER) Program reviews commercial and government off-the-shelf items in all twelve Inter-Agency Board (IAB) emergency equipment list categories. It serves to select, assess and evaluate specific emergency response gear such as personal protective equipment, explosive device mitigation and remediation equipment, CBRNE search and rescue equipment, physical security enhancement equipment, decontamination equipment, and the interoperability of emergency system components.

The Responder Assessment and Validation of User Equipment (RAVUE) is executed by the Center for Domestic Preparedness (CDP) in support of the SAVER program. It serves to provide "user-focused" information on weapons of mass destruction (WMD) response capabilities. Long term goals include assisting equipment and decision support developers in refining or improving Homeland Security capabilities, based upon Responder feedback on currently fielded WMD protection equipment and procedures.

When armed with reliable descriptions of how equipment items will perform, Emergency Response officials can allocate funds more wisely and, at the same time, ensure the safety of the men and women who depend on the equipment for their personal safety in emergency situations.

In addition, Federal grant funds on proven technology-based products and tools are better ensured through ODP Systems Support Division's (SSD) four-part program designed to address identified technical knowledge and product performance gaps. These four major ODP SSD program areas are:

- Independent specific equipment evaluation and validation of commercially available Emergency Responder products via the ODP SSD SAVER Program.

- "Honest Broker" technical assistance to State and local Emergency Responders.

- Setting assessment and validation guidelines and supporting standards development for key pieces of emergency response equipment.

- Outreach initiatives to disseminate accurate and useful information to State and local responders.

In practice, these four SSD enterprise areas are interrelated and work together by providing State and local emergency management decision makers with up-to-date product performance reviews, realistic product assessment and validation information. In this manner, ODP SSD can help assure that Federal funds are expended on high quality, technically reliable, and effective equipment that meet the needs of the Emergency Responder community.

2. EXTRICATION DEVICES ASSESSED

A. PROJECT PLANNING

The intent of the CDP RAVUE program is to provide user feedback and evaluation of equipment based on using equipment in scenarios that replicate the conditions that will be experienced in incident response. The objective of the first CDP RAVUE equipment evaluation was to produce assessment information on non-motorized extrication equipment using standardized Weapons of Mass Destruction (WMD) scenarios.

In preparing to conduct the Non-Motorized Extrication Devices assessment, a project management plan was developed, coordinated, and approved. The purpose of the assessment plan was to outline actions and activities necessary to accomplish user evaluations of this equipment in standardized WMD scenarios. Assessment evaluation criteria were recommended by an expert responder focus group which met on April 7, 2004. Following equipment procurement, the assessment was conducted on 23-25 June 2004, at the CDP main complex.

B. METHODOLOGY FOR SELECTING DEVICES

Several methods described in Section 10.002 of the Federal Acquisition Regulation were employed to identify manufacturers of extrication devices. Methods included an extensive Internet search, a review of applicable response equipment catalogs and other product literature published by manufacturers, as well as personal interviews with emergency responders. A Sources Sought Notice was posted on the Vendors Federal Business Opportunity website with a thirty day suspense. Additionally, letters were sent to 26 vendors inviting them to nominate their extrication devices for RAVUE

assessment. (*For additional information, see the document titled, "Extrication Devices Market Survey" dated May 12, 2004*.)

The list of potential vendors to whom solicitation letters were sent was developed through:

- Responder Interviews: Several CDP responders with years of Fire Service and experience were queried on potential manufacturers of non-motorized extrication devices. These interviews produced five potential sources.

- Web Searches: Researchers queried the government-wide database of contracts (www.contractdirectory.gov). Fourteen possible companies who specialize in the manufacture of extrication device equipment were identified.

  - The ZapConnect.com medical device database consisting of medical devices registered with the Food and Drug Administration was searched. Two searches were conducted and 121 records matched. From this number 17 manufacturing companies were identified.

  - Approximately 16 man-hours were spent on keyword searches of the Internet. Four additional manufacturing companies were identified.

- Professional Associations

  - Researchers reviewed the EMS Today Exhibitor List from the 21st annual EMS Today Exposition and Conference held in March 2003. Seven manufacturing companies were identified out of 152 exhibitors.

  - Researchers reviewed the January 2003 Fire Engineering Buyer's Guide. The buyer's guide provided names of manufacturers by trade name. Four possible manufacturers were identified.

  - Researchers obtained source lists of similar items from other agencies, trade associations, or other sources.

C. EXTRICATION DEVICES SELECTED

Twenty-six companies that produced extrication devices were contacted, of which nine responded. In addition, four companies responded to the Sources Sought Notice posted on the Vendors Federal Business Opportunity website. From these manufacturers, nine models were selected for testing.

1. Manufacturer Candidate Nominations

The products nominated were organized into 3 movement categories:

- Drag-type devices
- Carry devices
- Extrication chairs

2. Selection Process

In analyzing the individual nominations, it was noted that in several cases a manufacture had several models that were essentially identical in design and/or function as they might be used under RAVUE test conditions. Therefore, the CDP recommended that a "top-of-the-line" model from these vendors be tested. Where this occurred, the assessment report includes remarks about the other similar models offered and their potential performance under similar scenarios.

3. Selected Devices

The type extrication devices selected for use in the RAVUE assessment are depicted below and are listed in Table 2.1. They consist of five carry devices, three drag devices, and one extrication chair.

Table 2.1. Selected Extrication Devices

Company	Model
Activeaid, Inc.	#40B4C.I.D. Spineguard®
Arizona Industries for the Blind	Decontaminable Folding Pole Litter
Hartwell Medical Corporation	CombiCarrier®
Henley Board, Inc.	Henley Spinal Immobilization Device HB 1010
LifeSlider, Inc.	LS100 LifeSlider
Rapid Deployment Products, Inc.	Pro-Lite Spineboard® (716)
Red Sled, Inc.	RED SLED
Skedco, Inc.	HMD Sked®
Stryker Medical	Model 6253 Evacuation Chair

3. RAVUE ASSESSMENT OPERATIONS

A. ASSESSMENT SEQUENCE

Each assessment day, Evaluators had blood pressure checks performed and then met in classroom 2045 for the day's mission brief. There they were provided copies of the test plan for review, floor plans such as the graphics in Section 4 (RAVUE Lane Descriptions) below, a safety briefing, and briefed on the starting and ending points and locations of the victims they were to extricate. Additionally, all materials supplied by the device manufacturers were available for their review. After the mission briefing, Evaluators moved to the CDP hazardous materials training area, where they met with their assigned Data Recorders to perform a walk through of the lane they would be using that day.

Upon dressing out in their Level A PPE, Evaluators moved from room 1008 to their hot zone entry points, approximately seventy yards from their building exit points. At the hot zone entry point, the groups received their segment 1 extrication device as shown on Table 4.1 Equipment Distribution of Lanes in Section 4.D. Upon configuring the device and straps, the Evaluators masked and zipped up their suits and carried, pulled, or rolled their device into the hot zone and into Building 61. The two Data Recorders accompanied their Evaluator group, guiding them into the rooms containing the victims.

Evaluators extricated the specified non-ambulatory casualties from first and second floor locations and moved them approximately seventy yards from the building to the decontamination point. At the decontamination point, the victims were released to the simulated decontamination team. The Evaluators then took the same extrication device and returned to the incident site to extricate the

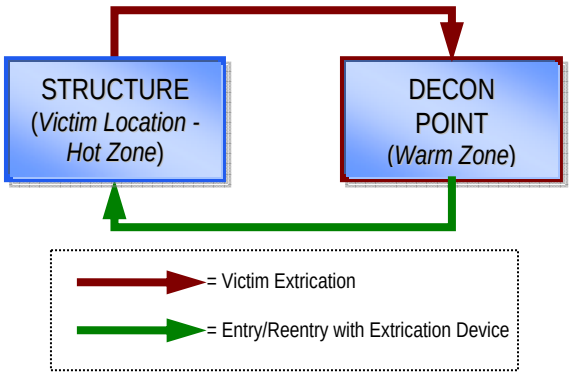


Figure 3.1 Extrication Operations Flow

next casualty (See Figure 3.1). In order to ensure objectivity, all devices were assessed by Responders under similar physical stress conditions; each device was evaluated by rested, slightly fatigued, and fatigued response personnel while in Level A PPE.

Three assessment segments were conducted in each lane per day. During each segment, Evaluators used a different extrication device for extricating three non-ambulatory victims. After extricating the third victim in the assessment segment, the Evaluator team temporarily halted assessment activities, hydrated (drank water to replenish fluids) themselves, and conducted a device debriefing. Following a one-hour rest and recovery period, the Evaluators initiated the second or third extrication vignette using a different extrication device. In this manner, the evaluator team extricated nine non-ambulatory victims using each device by the three Evaluator teams during the three assessment days.

B. SCORING OVERVIEW

In April 2004, a responder Focus Group recommended the extrication devices' evaluation criteria to be used in this assessment and prioritized each criteria within the High, Medium, and Low priority groupings. In order to maintain the integrity of each priority grouping, High, Medium, and Low group scores were calculated. The Focus Group also rated the evaluation criteria within each priority category from which weighting factors were calculated. By applying the weighting factor, the final assessment score incorporates both the Focus Group evaluation criteria and the observations of the hands-on Evaluators.

Under each evaluation criteria, between two and six debriefing questions were asked, with two to five discriminators each. Because of the varying numbers of response discriminators, the normalization process described in Section 10 (Scoring Methodology) Figure 10.2, was implemented. It is important to note that the debriefing questions were framed in such a way that the the lower score indicates a better performance. This Low Score Is Better approach is used throughout this report and the appendices. For a detailed explanation of all calculations used to obtain the final scores, please see Section 10 (Scoring Methodology).

C. ASSESSMENT SCENARIOS

The following paragraphs describe the tactical situation within which the RAVUE Evaluators will operate and develop equipment assessments.

1. Tactical Situation (Simulated)

A low-order bomb with an organophosphate component has been detonated in the locations listed below. The incident scene has been secured with a perimeter approximately three hundred yards around the incident site. A hot zone was established within the isolation area at a distance of approximately seventy yards from the victim's locations with a decontamination point at the edge of the hot zone.

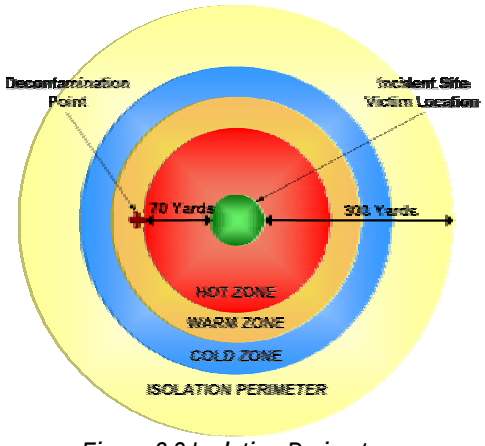


Figure 3.2 Isolation Perimeter

Numerous fatalities have been located in the building and the local response group has determined that only a slight potential for liquid contamination exists within the hot zone. As a result of the information gathered, the Incident Commander coordinated with the Public Health Officer and other EMA authorities and determined that a toxic hazard may still exist within the hot zone, especially on victims near the release point.

Triage has been performed and ambulatory victims were moved to and through decontamination. Twenty-seven non-ambulatory victims had been identified for rapid movement from their locations to the decontamination area. Nine victims had been coded Red (requiring immediate treatment to prevent more serious injury or death) and the remainder have been coded Yellow (serious injury; non life-threatening). Victims have been fitted with escape masks and other injuries have been stabilized to permit extrication.

2. Extrication Mission Statement

Due to the condition of the three Red victims, time did not permit Responders to await additional equipment or personnel. Therefore, "first-on-the-scene" personnel were required to begin extrication using the equipment on their vehicles. As additional extrication devices and equipment arrived at the scene, that equipment was provided to the responders working in the hot zone, so that hot zone personnel wearing Level A PPE did not have to wait for victims to be removed from the extrication devices during decontamination.

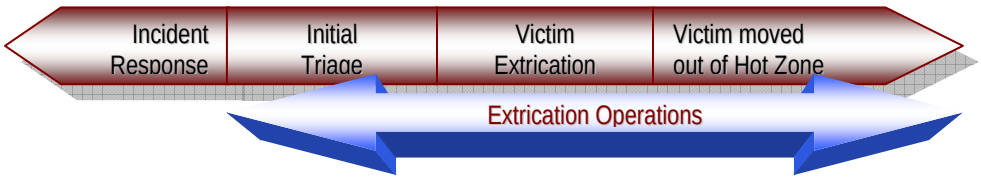


Figure 3.3 WMD Extrication Scenario Timeline

Because investigation of the WMD incident was still ongoing and the extent of the hazard has not been fully characterized, the Incident Commander directs Level A protection to be worn in the hot zone.

The scenarios required extricating immobile, unconscious individuals, simulated by mannequins weighing approximately 165 pounds, from first and second floor rooms accessed by a standard-sized door at least 36 inches wide. The rooms contained representative furniture of dimensions and weight that could be found in typical office, commercial, or government building settings.

4. RAVUE LANE DESCRIPTIONS

A. LANES

Daily assessment activities were divided into three segments, each segment using a different extrication device. To begin an assessment segment, four responders were briefed on the location of immobile victims that had been triaged and stabilized. Six scenario areas (lanes) consisting of a grouping of adjacent rooms and an evacuation route leading back to the hot zone entrance/ decontamination point were used over the three day assessment period. There was no intent to execute the scenarios in any given order. However, each Evaluator group used only one lane on an assessment day.

B. SEGMENTS

The assessment began and ended at the entrance to the hot zone where the Responder Evaluators picked up the extrication device and took it into the building to extricate the victims. After three extrications, the Evaluators undressed, rested, re-hydrated, and conducted a device debriefing before proceeding to the next segment using another device to extract victims from the same area.

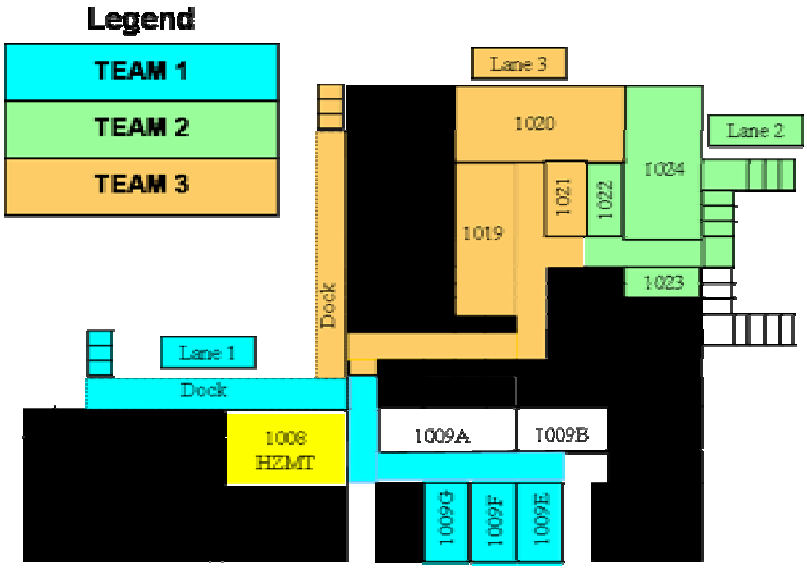
C. VIGNETTES

The following schematics and lane descriptions provide an overview of the lane settings used for the assessments. Readers are encouraged to examine these descriptions and to correlate the specific equipment evaluated during the vignettes as described in Table 4.1 Equipment Distribution of Lanes in Section 4.D.

1. Assessment Day 1 - Extrication Device Lanes

The weather during Day 1 was overcast with temperatures ranging from ~72° F to ~80° F.

Day 1 - First Floor



a. Lane 1 - Team 1 - Carry Devices 1, 2, and 3

Lane 1 consisted of rooms 1009E, 1009F, and 1009G in Building 61 in the CDP HAZMAT training area. These rooms were set up as offices and a classroom with desks, chairs, etc. as shown in the pictures below.

OFFICE SETTING	CLASSROOM SETTING	OFFICE SETTING
		
ROOM 1009 E	ROOM 1009 F	ROOM 1009 G

In Lane 1, Evaluators extricated one victim from each room and proceeded through the hallway to exit the building via the loading dock. The Evaluators then either carried the victim down a short set of stairs or dragged the victim strapped to the device from the 4' high loading dock (photos on following page).

HAZMAT LOADING DOCK	HAZMAT LOADING DOCK
	
BUILDING 61	CAFETERIA EXIT

b. Lane 2 - Team 2 - Drag Devices 1, 2, and 3

Lane 2 utilized rooms 1022, 1023, and 1024 in Building 61, also in the CDP hazardous materials training area. These rooms were configured as a waiting room, the judge's chambers, and a court room, as shown in the pictures below.

WAITING ROOM	JUDGE'S CHAMBERS	COURTROOM
		
ROOM 1022	ROOM 1023	ROOM 1024

In Lane 2, Evaluators extricated one victim from each room. Teams traveled out of the building and down the fifteen steps shown in the photographs below. Upon reaching the ground, the group dragged the victim down the stairs, to the decontamination point approximately seventy yards away.

COURT AREA HALLWAY	COURT AREA STAIRS	COURT AREA STAIRS
		
TO COURT AREA STAIRS	UPPER LANDING	LOWER LANDING

c. Lane 3 - Team 3 - Carry Devices 4 and 5, Chair

Lane 3 was a first floor extrication from a cafeteria area, a dining room, and a clinic room, shown in the pictures below. This lane utilized rooms 1019, 1020, and 1021 in Building 61 in the CDP Training area. These rooms also had numerous non-viable victims.

CAFETERIA AREA	DINING ROOM	CLINIC
		
ROOM 1019	ROOM 1020	ROOM 1021

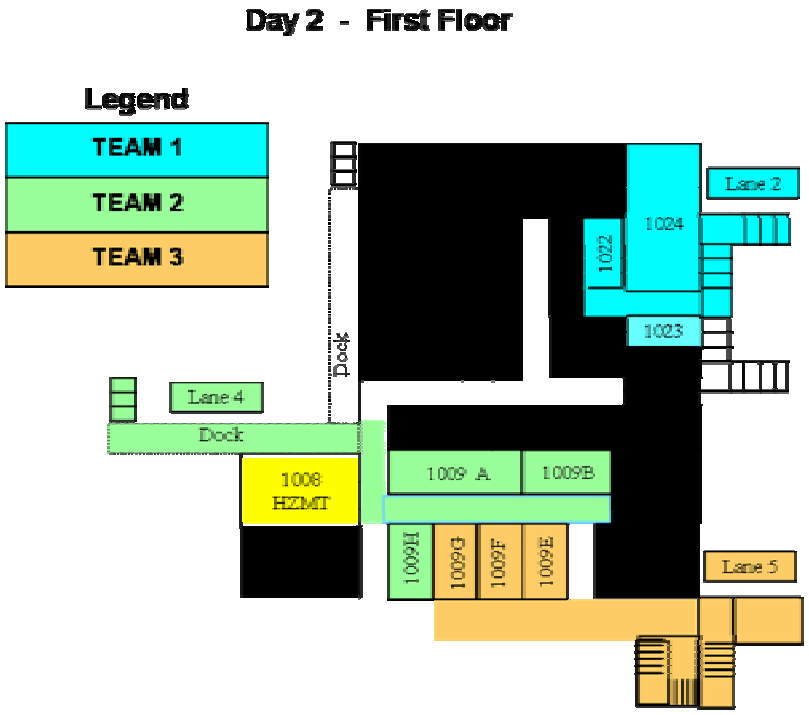
In Lane 3, Evaluators extricated one victim from each room to the loading dock and either carried the victim down a short set of stairs or slide the victim strapped to a device from the 4' high loading dock. Evaluators found that the narrow steps on Lane 1 and 3 caused them to have to carry the backboard down the stairs with only two people when wearing the bulky PPE. By sliding the patient off of the dock, all four responders could share the weight burden.

HAZMAT LOADING DOCK	HAZMAT LOADING DOCK
	
WALKWAY TO STAIRS	STAIRS

2. Assessment Day 2 - Extrication Devices Lanes

The weather during Day 2 was overcast with intermittent rain with temperatures ranging from ~75° F to ~82° F.

Throughout the assessments, the tactical scenario remained unchanged. Therefore, twenty-seven extrications were performed and nine devices were assessed daily.



a. Lane 2 - Team 1 - Carry Devices 4 and 5, Chair

Lane 2 again utilized rooms 1022, 1023, and 1024 in Building 61, also in the CDP training area. These rooms are set up as a waiting room, the judge's chambers, and a court room as shown in the pictures below.

WAITING ROOM	JUDGE'S CHAMBERS	COURT ROOM
		
ROOM 1022	ROOM 1023	ROOM 1024

In Lane 2, Evaluators extricated one viable victim from each room. Teams traveled out of the building and down the fifteen steps shown in the photographs below. Upon reaching the ground, the group rolled or carried the victim down the stairs and to the decontamination point approximately seventy yards away.

COURT AREA HALLWAY	COURT AREA STAIRS	COURT AREA STAIRS
		
TO COURT AREA STAIRS	UPPER LANDING	LOWER LANDING

b. Lane 4 - Team 2 - Carry Devices 1, 2, and 3

Lane 4 utilized rooms 1009A and 1009B in the Training area. However, Lane 4 incorporated the loading dock used in Lane 3. Two extrication victims were located in room 1009A and one was in room 1009B. Pictures of these instructional rooms are shown below.

HAZMAT ROOM	HAZMAT ROOM
	
ROOM 1009 A	ROOM 1009 B

HAZMAT LOADING DOCK	HAZMAT LOADING DOCK
	
WALKWAY TO STAIRS	STAIRS

c. Lane 5 - Team 3 - Drag Devices 1, 2, and 3

Lane 5 consisted of rooms 1009E, 1009F, and 1009G in Building 61 in the CDP training area. These are the same rooms as used in Lane 1, however the exit was down a wide set of interior stairs leading to the east side of Building 61. These rooms were configured in office and classroom settings

with office furnishings. as shown in the pictures below. In Lane 5, Evaluators extricated one victim from each room.

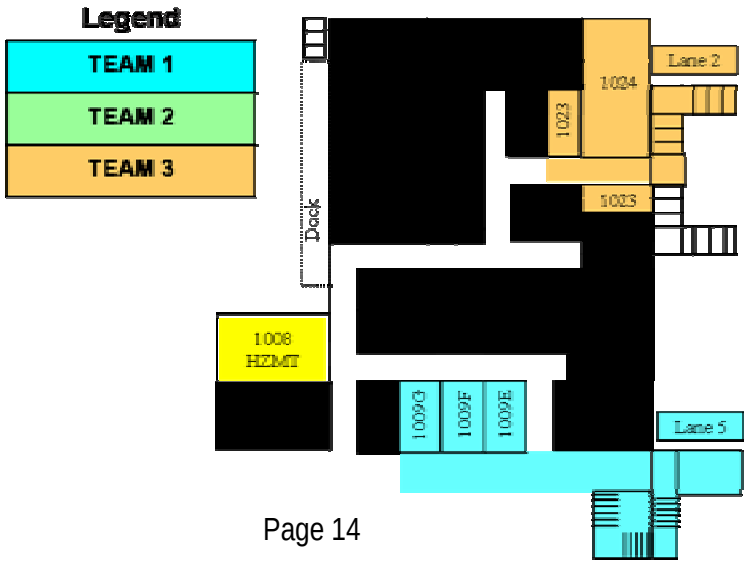
OFFICE SETTING	CLASSROOM SETTING	OFFICE SETTING
		
HAZMAT 1009 E	HAZMAT 1009 F	HAZMAT 1009 G

HAZMAT STAIRS	2ND FLOOR STAIRS	BLDG 61 – EAST SIDE
		
MIDDLE LANDING	LOWER LANDING	TO DECON AREA

3. Assessment Day 3 - Extrication Device Lanes

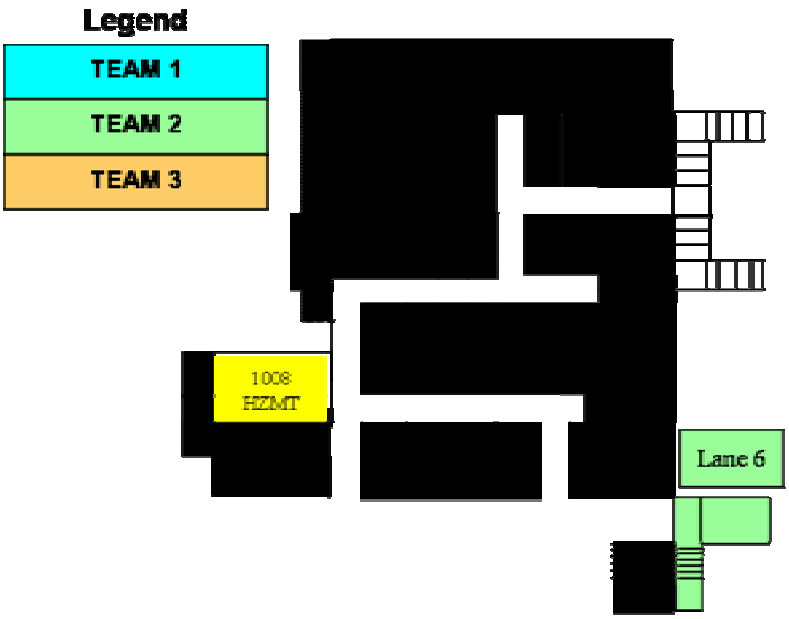
The weather during Day 3 was overcast with intermittent rain and temperatures ranging from ~80° F to ~87° F.

Day 3 - First Floor
Teams 1 & 3

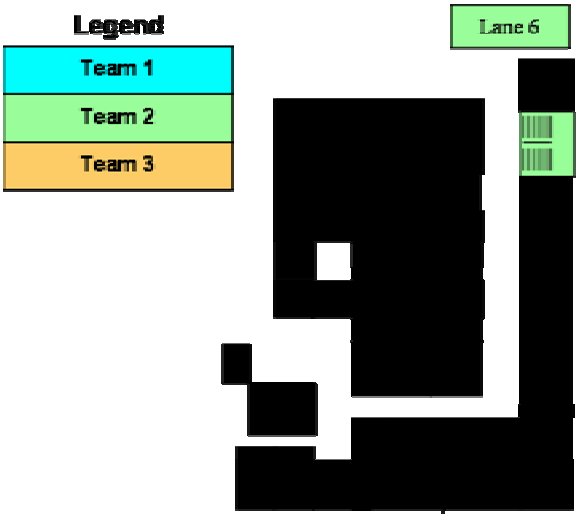


On Day 3, Team 1 used the interior stairwell on the east side of Building 61 to access an outside entrance. The following two floor diagrams indicate the areas used by Team 1, starting on the second floor and descending to the ground level.

Day 3 - First Floor
Team 2



Day 3 - Second Floor
Team 2



a. Lane 2 - Team 3 - Carry Devices 1, 2, and 3

Lane 2 again utilized rooms 1022, 1023, and 1024 in Building 61 and the exterior stairway, as on previous assessment days. These rooms were set up as a waiting room, a court room, and the judge's chambers as shown in the pictures below.

WAITING ROOM	JUDGE'S CHAMBERS	COURTROOM
		
ROOM 1022	ROOM 1023	ROOM 1024

In Lane 2, Evaluators extricated one victim from each room. Teams exited down the fifteen steps shown in the photographs below. Upon reaching the ground, the group carried the victim to the decontamination point approximately seventy yards away.

COURT AREA HALLWAY	COURT AREA STAIRS	COURT AREA STAIRS
		
TO COURT AREA STAIRS	UPPER LANDING	LOWER LANDING

b. Lane 5 - Team 1 - Drag Devices 1, 2, and 3

Lane 5 utilized rooms 1009E, 1009F, and 1009G set up in office and classroom settings with office furnishings as shown in the pictures on the following page. The exit route was down a wide set of interior stairs leading to the east side of Building 61. In Lane 5, Evaluators extricated a victim from each room.

OFFICE SETTING	CLASSROOM SETTING	OFFICE SETTING
		
ROOM 1009 E	ROOM 1009 F	ROOM 1009 G

Because Teams 1 and 2 were using the same stairwell to extricate victims, there were several instances during which a team had to momentarily wait for the other to enter or exit the doorway or move a victim past the other group. However, this congestion was brief and no noticeable interruption of the extrication flow occurred.

HAZMAT STAIRS	2ND FLOOR STAIRS	BLDG 61 – EAST SIDE
		
MIDDLE LANDING	LOWER LANDING	TO DECON AREA

c. Lane 6 - Team 2 - Carry Devices 4 and 5, Chair

Lane 6 used the interior stairwell on the east side of Building 61 with one mannequin placed approximately six steps below the upper most landing on the second floor. The other two mannequins were placed on the third landing above the ground floor. All extrications were made to the decontamination point located near the road in the background of the picture labeled “Bldg 61 – East Side To Decon Area.” During the descent, Evaluators carried the victim down thirty-three stairs to reach the ground level.

3RD FLOOR STAIRS	2ND FLOOR STAIRS	BLDG 61 – EAST SIDE
		
TOP LANDING	LOWER LANDING	TO DECON AREA

D. ROTATION OF DEVICES BETWEEN THE LANES

Each Evaluator team conducted nine extrications from first floor locations, characterized by no more than six stair steps leading out of the building. Additionally, each group performed 18 additional extrications from second floor locations with over fifteen stair steps leading from the building. This resulted in each device being used for three extrications per day, for a total of nine total extrications per device.

In conducting the assessments, each Evaluator team donned their PPE and then moved to the hot zone to obtain their extrication device. Some groups preferred to configure the devices prior to entry into the hot zone versus configuring them once they had arrived at the victim's location. Therefore, the routine prior to the entry varied slightly. Evaluator teams then moved into the hot zone, carrying, pulling, or rolling the device being assessed.

Two devices from each manufacturer were provided during each assessment segment for the Evaluator teams use. The exception to this was the extrication chair, of which only one was available. At the beginning of an assessment, the two devices were placed at the start location of the hot zone. In most cases, Evaluators took both devices into the hot zone at the beginning of the segment, regardless of the number of responders required to extricate a single victim. Evaluator teams made two entries into the hot zone in a single segment.

During the segment debriefings, CDP logistics personnel moved the extricated mannequins back into the rooms/ locations from which they had been moved and replaced the assessed devices with the next item in the rotation. The table below shows the specific items used in the lanes on each day.

A concerted effort was made to evaluate all devices by rested, slightly fatigued, and fatigued personnel. The slight deviation to this occurred with the Henley Spineboard®. The board was used in in Segment one (rested) on one day, and Segment three (fatigued condition) on two days. Because it was used after a one-hour debriefing and a lunch hour on Day two, the Spineboard® was assessed under a slightly fatigued condition. Therefore, the Henley Spineboard® was assessed under rested, slightly fatigued, and fatigued conditions.

Table 4.1 Equipment Distribution of Lanes

Day 1 - Equipment Assessment			
Order	Team 1 – Lane 1	Team 2 – Lane 2	Team 3 – Lane 3
1	Spineguard®	Life Slider	Henley Spine Board
2	Folding Pole Litter	Red Sled	Extrication Chair
3	CombiCarrier®	SKED®	Pro-Lite Spineboard®
Day 2 - Equipment Assessment			
Order	Team 1 – Lane 2	Team 2 – Lane 4	Team 3 – Lane 5
1	Extrication Chair	CombiCarrier®	SKED®
2	Pro-Lite Spineboard®	Spineguard®	Life Slider
3	Henley Spine Board	Folding Pole Litter	Red Sled
Day 3 - Equipment Assessment			
Order	Team 1 – Lane 5	Team 2 – Lane 6	Team 3 – Lane 3
1	Red Sled	Pro-Lite Spineboard®	Folding Pole Litter
2	SKED®	Extrication Chair	CombiCarrier®
3	Life Slider	Henley Spine Board	Spineguard®

5. DEBRIEFING PROCESS

After an assessment segment consisting of three extrications using a single device, the Evaluator teams returned to room 1008, removed their PPE and proceeded to the Responder dining area for the segment debrief. This began with each Evaluator filling out the Debriefing Worksheet contained in Appendix B of this report.

Evaluators were permitted to interact and discuss their observations during this individual scoring of the devices, but each Evaluator formulated their impressions and comments individually. Upon completion of the individual debriefing worksheets, the Evaluator team discussed the assessment and the Data Recorders recorded the collective ratings and comments on the device. In some cases, Evaluators reviewed the manufacturer's instructions or promotional literature or even brought the devices into the room, to inspect them and to discuss specific performance issues.

The debriefing process generally required approximately one hour. If an Evaluator chose to, he could modify anything on his debriefing worksheet during the group's discussions; although there was little indication that extensive changes were made. At the conclusion of each segment's debriefings, score sheets were collected by the Assessment Director.

In addition, after the last debriefing on Friday, June 25, 2004, Evaluators were given a final opportunity to modify any assessment ratings or comments that they had previously submitted. For the Non-Motorized Extrication Devices Assessment, no one chose to do so.

6. EVALUATOR FAMILIARIZATION WITH ASSESSMENT DEVICES

A. INITIAL ORIENTATION

Instructional or promotional materials that the device manufacturer had provided in nominating their product(s) for the RAVUE assessment were provided to the Evaluators in a classroom familiarization session on Tuesday morning, June 22, 2004. These materials included promotional brochures, VHS demonstration tapes, and DVD demonstration tapes. The morning familiarization session lasted approximately one hour, with Evaluators reviewing materials and discussing their experience and observations with the group. To avoid biasing the Evaluators, no CDP instruction on the devices was provided to the Evaluators. However, if the Evaluators had questions on the devices, the Test and Evaluation Branch attempted to obtain answers to Evaluator questions, principally by researching manufacturer web-sites.

B. HANDS-ON FAMILIARIZATION

Tuesday afternoon, Evaluators were taken to the CDP Library, where the boxed RAVUE equipment was provided to them along with as much time needed to open, configure, and practice using the devices. During this "hands-on" session, Evaluators had access to the literature previously provided in the classroom familiarization as well as materials that were contained in the un-opened boxes with the devices.

Of particular note was the lack of instructions for the military style Folding Pole Litter and the Pro-Lite Spineboard®. In the case of the military litter, the Evaluators did not know until the third assessment day that the handles on the Folding Litter could be extended by pushing small, inconspicuous buttons on each handle. Additionally, the Pole Litter did not have patient immobilization straps, which sometimes made it difficult to keep the victim in place when descending stairs.

C. FOLLOW ON CLASSROOM FAMILIARIZATION

After familiarization in the Library, the Evaluators returned to the classroom to again review the available literature and to re-review the equipment demonstration tapes and DVDs. Upon completing the "self-teaching" seminar Tuesday afternoon, Evaluators were offered the opportunity to review the literature each morning during the daily mission briefing as well as during the segment debriefs. However, few groups availed themselves of these additional opportunities, with the exception of periodically reviewing the patient restraint systems on the Henley Spineboards®, due to their unique lacing configuration.

D. ACCESSORY ITEM PROCUREMENT

As received, the Pro-Lite Spineboard® did not have immobilization straps or a head immobilization system as found on the other backboard type devices. Investigation of the materials and information provided by the manufacturer did not indicate whether

the device had such straps. However, Evaluators determined that such straps were necessary to safely extricate victims in the scenarios being portrayed. Therefore, the CDP placed an expedited order with the manufacturer, Rapid Deployment Products, to have the appropriate straps and head device shipped overnight express, to arrive before the assessment began the following day.

7. RAVUE EVALUATORS

Participants were selected on geographic considerations and responder disciplines. The desired qualifications were responders at the technician and operation level from Fire Service, Law Enforcement, EMS, Search and Rescue, and EMA disciplines representing large, medium, and small communities across the country.

A. EVALUATOR QUALIFICATIONS

Because of the type of response activity to be performed, response agencies and departments located throughout the United States were asked to nominate equipment Evaluators who possessed the following characteristics meeting the following requirements:

- Certified or accredited to perform duties while wearing Level A PPE.
- Completed a physical examination by a licensed physician within the last twelve months indicating that the individual is fully capable of performing Responder duties including wearing an air purifying respirator.
- Physically fit health status.
- Three or more years of experience working in Level A PPE.
- Willing to perform strenuous extrication operations in a non-hazardous environment.
- Willing to sign a No Conflict of Interest Statement.

B. EVALUATOR SELECTION

The candidate jurisdictions were identified using the Center for Domestic Preparedness Student Services database containing the names of attendees from previous courses. Supervisors within these jurisdictions were contacted and asked to make an evaluator nomination. Nominated responders were then selected based upon their level of experience using PPE equipment within their disciplines and jurisdictions.

The twelve selected responders met the requirements as listed in paragraph A.1 above. However, no law enforcement personnel were nominated to participate in the assessment. Based on department feedback, this was primarily due to the lack of candidate experience in working in Level A PPE or not having personnel available during this time period. Consequently, nominated and selected personnel represented the Fire Service, HAZMAT, Search and Rescue, and emergency medical expertise. Additionally, only male nominations were received.

C. EVALUATOR DEMOGRAPHICS

Table 7.1 shows the demographics of the selected evaluators.

Table 7.1. Evaluator Demographics

Age Range	Occupation	Years - Experience/Discipline	State
26-35	Fire/HZT Co./Paramedic	6 Fire, 3 HZT	Arkansas
26-35		20 Fire, 11 HZT	Pennsylvania
26-35	Engineer/Operator/ HZT	8 HZT, 5 Rescue, 5 FEMA	Texas
26-35	HZT Tech/ Fire/Medic	15 Fire, 12 HZT	Maryland
26-35	Fire, Paramedic, Trng Co.	5 Fire, 9 EMT, 4 HZT Tech	Alabama
26-35	Driver/Operator/HZT Tech	8 HZT, Rescue	New Mexico
36-45	Fire/HZT	16 Fire/Rescue, 23 HZT	Illinois
36-45	Fire/HZT/EMT	18 Fire	West Virginia
36-45	Fire/EMT/HZT	14 Fire	West Virginia
36-45	Specialist	HZT Spec., Search & Rescue	New York
46-55	Captain	24 Fire	Georgia
> 55	Asst. Chief	31 Fire	Vermont

8. DATA RECORDERS

Data Recorders were selected from the CDP training staff, possessing the skills and experience similar to the Evaluators in utilizing the type equipment being evaluated. Two Data Recorders observed Evaluator team activities on each test lane.

A. DATA RECORDER RESPONSIBILITIES

Data Recorders accompanied the teams during extrication operations and collected and recorded Evaluator comments and observations. Data Recorders ensured that safety considerations were adhered to during the assessment and in Evaluator re-hydration and recovery. Protection of the simulated victim was also be controlled by the Data Recorder to ensure that appropriate victim placement and restraint procedures were followed.

Immediately following each assessment segment, the Data Recorder conducted a debriefing at the back of the Responder Cafeteria in Building 61. At that time, Evaluators recorded their assessment observations, and data collected on the Evaluator Debriefing Worksheets was provided to the Data Recorders.

Data Recorders submitted the completed debriefing worksheets to the Assessment Director at the end of each test day. The Assessment Director reviewed the information and identified any additional data points that may have been required as a result of Evaluator comments. Any procedural adjustments or information provided by Evaluators were documented in the Data Recorder's/Test Director's daily situation report.

B. DATA RECORDER DEMOGRAPHICS

Table 8.1 shows the demographics of the Data Recorders.

Table 8.1 Data Recorder Demographics

CDP Department	Age Range	Discipline	Years Experience
TERT Training	26-35	Law Enforcement	2½
Training	26-35	HAZMAT	7
Incident Command Training	36-45	CBRN Defense (Military)	21
Training	46-55	Fire Service/EMT	25
Training	46-55	Fire Service/HAZMAT	25
Training	46-55	Fire Service	24

9. EVALUATION CRITERIA

The Extrication Device Focus Group, which met in April 2004, recommended that the Center for Domestic Preparedness evaluate the WMD response extrication equipment using the following assessment criteria. These criteria are grouped in order of importance, beginning with the assessment criteria judged to be of greatest importance. Data was collected to assess the efficacy of the devices within these categories, but without any attempt to reach a "grand total score" by combining scores between the High, Medium, and Low priority criteria. Focus Group recommendations were as follows:

A. HIGH PRIORITY CRITERIA

The following seven assessment criteria were considered to be of greatest importance in the described extrication operations:

- Ease of use (patient packaging/movement)
- Lightweight (includes weight rating)
- Portability

- Durability
- Non-reactive/re-usable/multiple uses (same event)
- Use in multiple environments (vertical/horizontal)
- Ease of decontamination (to limit cross contamination)

B. MEDIUM PRIORITY CRITERIA

These four assessment criteria were judged to be of medium importance:

- Equipment compatibility (interaction with other types of equipment)
- Cost
- Ease of assembly (color coded)
- Storage

C. LOW PRIORITY CRITERIA

These five assessment criteria were judged to be low priority evaluation criteria:

- Inter-agency compatibility
- Sizability (infant/adult)
- Simple/clear instructions or diagrams (international)
- Recoverability
- Disposability (upon completion of the extrication operations)

10. SCORING METHODOLOGY

The following describes the method used to determine scores for each device within the High, Medium, and Low priority groupings. The numerical data is presented for each device in the tabulation tables in Appendix C. These tables are divided into three parts for the High Priority Score, Medium Priority Score, and the Low Priority Score. Several computational factors were used in calculating the final scores and are described in the discussion below. However, the formula for the overall scoring calculations is:

$$\frac{\text{AT}}{\text{TPP}} \times 100 = \text{EPS} \times m = \text{UWS} \times \text{WF} = \text{CS}$$

$$\sum \text{CS (within priority grouping)} = \text{SS} \times \text{PSF} = \text{PS}$$

Assessment Tool (AS)
Criteria Score (CS)
Evaluator Percentage Score (EPS)
m = slope
Priority Score (PS)
Priority Spread Factor (PSF)
Score Subtotal (SS)
Total Possible Points (TPP)
Un-weighted Score (UWS)
Weighting Factor (WF)
Σ = the sum of

The example in the shaded boxes below demonstrates the process algebraically presented on the previous page.

An Example

Below are the actual calculations for CombiCarrier® for the High Priority Score. The Medium and Low Priority Scores are obtained using the same calculations except the Priority Spread Factor is 2 for medium and 3 for low and the evaluation criteria weighting factors were different. The priority spread factor is only used to allow easier discrimination between priority group calculations and does not change the relative performance score within the High, Medium, or Low grouping.

Table 10.1. CombiCarrier® – High Priority Criteria Score Tabulations

Evaluation Criteria	Assessment Total	Percentage Score	Un-weighted Score	Weighting Factor	Criteria Score
1.0 Ease of Use	181	50.28	2.51	1.63	4.09
2.0 Lightweight	67	37.43	1.87	2.5	4.68
3.0 Portability	68	56.67	2.83	2.63	7.44
4.0 Durability	32	14.81	0.74	2.75	2.04
5.0 Reusable/Multiply Extractions	43	35.83	1.79	2.25	4.03
6.0 Use in Multiple Environments	93	53.14	2.66	4	10.64
7.0 Ease of Decontamination	34	37.78	1.89	2.88	5.44

Score Subtotal	38.36
Priority Spread Factor	x 1
(HIGH) PRIORITY SCORE	38.36

Assessment Total (AT). The Assessment Total is the sum of all the evaluators' scores within the evaluation criteria. When an evaluator circled two answers, the highest score was used. Also on question 11.3 two "no" answers were given as a choice to circle, one with a value of 1 and the other with a value of 5. All 5's were given a value of 1.

Assessment Total (AT)

Taken directly from the responders' scores.

Evaluator Percentage Score (EPS). The Assessment Total was converted to a percentage using the equation in Figure 1. If an evaluator left an answer blank, the Total Possible Points (TPP) were adjusted.

$$Percentage = \frac{\text{Assessment Total}}{\text{Total Possible Points}} \times 100$$

Figure 10.1 Equation for Percentage

Evaluator Percentage Score (EPS)

Table 10.2 below shows the numbers used for calculating percentages and how they were derived:

Table 10.2. CombiCarrier® - Total Possible Points (TPP)

Evaluation Criteria	Potential Total Points	Number of Points Deducted (No Answer Given)	Total Possible Points Used for Calculations
1.0	360	0	360
2.0	204	25	179
3.0	120	0	120
4.0	216	0	216
5.0	120	0	120
6.0	180	5	175
7.0	120	30	90

- Assessment Total ÷ Total Possible Points x 100 = Evaluator Percentage Score
  - Criteria 1.0. 181 ÷ 360 x 100 = 50.28 (all numbers rounded to 2 decimal points)
  - Criteria 2.0. 67 ÷ 179 x 100 = 37.43
  - Criteria 3.0. 68 ÷ 120 x 100 = 56.67
  - Criteria 4.0. 32 ÷ 216 x 100 = 14.81
  - Criteria 5.0. 43 ÷ 120 x 100 = 35.83
  - Criteria 6.0. 93 ÷ 175 x 100 = 53.14
  - Criteria 7.0. 34 ÷ 90 x 100 = 37.78

Unweighted Score (UWS). The unweighted score was used to establish a range from 0 to 5. A linear equation gives a direct correlation from the percentage (range 0 to 100) to the unweighted score (range 0 to 5). The equation is Unweighted Score (y-value) equals 0.05 x Percentage (x-value).

Unweighted Score (UWS)

See Figure 10.4 for a graphical representation of how the unweighted score is found.

Percentage x 0.05 = Unweighted Score

- Criteria 1.0 50.28 x 0.05 = 2.51
- Criteria 2.0 37.43 x 0.05 = 1.87
- Criteria 3.0 56.67 x 0.05 = 2.83
- Criteria 4.0 14.81 x 0.05 = 0.74
- Criteria 5.0 35.83 x 0.05 = 1.79
- Criteria 6.0 53.14 x 0.05 = 2.66
- Criteria 7.0 37.78 x 0.05 = 1.89

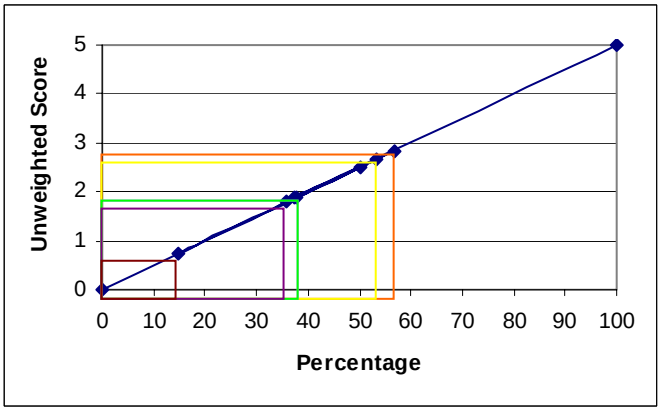


Figure 10.2. CombiCarrier® –Unweighted

Calculating the Equation of the Line and Scope

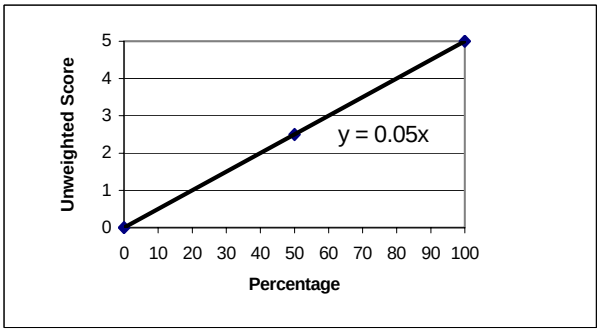
The slope-intercept equation (y = mx + b) for a line is used for convenience. In this equation m is slope and b is the value of y where the line crosses the y-axis, which in this case is 0 (b=0).

If the device received 100 percent of the total possible points, it would receive an unweighted score of 5. If the device received 0 percent of the total possible points it would receive an unweighted score of 0. Therefore, the two points (100, 5) and (0, 0) were used to find the slope (m) of the line.

$$slope\,(m) = \frac{\Delta Y}{\Delta X} = \frac{5-0}{100-0} = \frac{5}{100} = 0.05$$

w here Δ(Delta) = the change in

Therefore, the equation is y=0.05x, where y is the unweighted score and x is percentage.



Graph of the Line (y = 0.05x)

Weighting Factor (WF). The weighting factor for the evaluation criteria does not change and is constant for each device. During the Evaluation Criteria Focus Group meeting, the Group prioritized the assessment criteria within the priority groupings shown in Section 9. Subsequently, each group member rated the relative importance of the criteria identified by the Group with the lowest ranking (1) being the criteria of most importance and the highest ranking (10) being the least important. The actual weights assigned by the individual Focus Group members are shown in the table below.

Weighting Factors (WF)

Table 10.3 Extrication Devices Weighting Factors

Priority Group	Evaluation Criteria	Weighting Factor
1	Ease of Use (Patient Packaging/Movement)	1.63
1	Lightweight	2.5
1	Portability	2.63
1	Durability	2.75
1	Non-reactive/ Reusable/ Multiple Extractions	2.25
1	Use in Multiple Environments (Verticall/Horizontal)	4
1	Ease of Decontamination (Prevent Cross Contamination)	2.88
2	Equipment Compatibility (With Other Types of Equipment)	4.75
2	Cost	4.75
2	Ease of Assembly	4.63
2	Storage	3.75
3	Interagency Compatibility	5.13
3	Sizability (Infant/ Adult)	4.75
3	Simple/ Clear Instructions or Diagrams	3.75
3	Recoverability	6.13
3	Disposability	5.13

Criteria Score (CS). The Criteria Score was calculated by multiplying the weighting factor by the unweighted score.

Score Subtotal (SS). All Criteria Scores under a priority group were summed to obtain a Score Subtotal.

Criteria Score (CS) and Score Subtotal (SS)

Unweighted Score x Weighting Factor = Criteria Score.

Score Subtotal = sum of the Criteria Scores

- Criteria 1.0. 2.51 x 1.63 = 4.09
- Criteria 2.0. 1.87 x 2.50 = 4.68
- Criteria 3.0. 2.83 x 2.63 = 7.44
- Criteria 4.0. 0.74 x 2.75 = 2.04
- Criteria 5.0. 1.79 x 2.25 = 4.03
- Criteria 6.0. 2.66 x 4.00 = 10.64
- Criteria 7.0. 1.89 x 2.88 = 5.44

Score Subtotal = 38.36

Priority Score (PS) In order to avoid confusion between the Priority Groupings, a multiplication factor of 1, 2, and 3 was used to create a spread between the groups. The Score Subtotal was multiplied by the Priority Spread Factor (PSF) of 1 for high, 2 for medium, and 3 for low to obtain the respective Priority Score. This in no way skewed the results, however, as the results of the groups were not added or averaged to achieve a grand total ranking. That is to say that high, medium, and low priority issues were only weighed among themselves.

Priority Score (PS)

Since this example uses the High Priority group, the priority spread factor used is 1. When finding the Medium Priority Score and Low Priority Score, one would multiply by 2 and 3 respectively.

Score Subtotal x Priority Spreading Factor = Priority Score

- 38.36 x 1 = 38.36

11. ASSESSMENT RESULTS

Overall, the Evaluator teams were able to successfully accomplish the mission in each scenario with each device. The numerical results are presented in Table B-1 below. Each device has three scores that represent the Evaluators' assessment of the device in the different priority categories (High, Medium, and Low). The lower the score in the table, the better the device performance.

Table 11.1. Results

Extrication Device	High Priority Criteria Score	Medium Priority Criteria Score	Low Priority Criteria Score
CombiCarrier®	38.36	61.64	151.77
Evacuation Chair	29.02	60.3	137.34
Folding Pole Litter	34.91	78.28	143.1
Henley Spinal Device	52.49	62.18	191.79
HMD Sked®	29.35	54.6	96.39
LifeSlider	36.41	67.98	159.84
Pro-Lite Spineboard®	39.32	54.48	117.93
RED SLED	40.99	67	137.73
Spineguard®	40.49	60.18	129.12

Evaluator Responses - High Priority Criteria

Based on the Focus Group High Priority Criteria listed in paragraph 9.A and the scoring data listed in Appendix C of this report, the scoring order was as depicted in the table at the right. Discussion of the evaluation criteria not able to be evaluated or device anomalies are discussed in the paragraphs following.

High Priority Scoring Order
Evacuation Chair
HMD Sked®
Folding Pole Litter
LifeSlider
CombiCarrier®
Pro-Lite Spineboard®
Spineguard®
Red Sled
Henley Spinal Device

CRITERIA

- Ease of Use
- Lightweight
- Portability
- Durability
- Non-Reactive/ Reusable/Multiple Extrications
- Use in Multiple Environments
- Ease of Decontamination

Non-Reactive/Reusable/ Multiple Extrications. A low score (good results) in this criterion indicates that the evaluators were able to reuse the device for multiple extrications and that the device required minor (if any) adjustments between extrications. No scientific testing was conducted to determine the reactivity of the materials with different chemicals or decontaminants.

Ease of Decontamination. Actual device decontamination was not performed during the assessment. However, a low score (good result) in this category indicates that the evaluators felt that the device could be satisfactorilly rinsed to reduce cross-contamination of victims and responders.

Non-Routine Operational Profiles. The RAVUE scenarios caused some extrication devices to be used in mission profiles not routinely promoted by the manufacturers. However, the equipment was not used in a manner in which the manufacturer has issued a warning or caution. For example, several Evaluators commented that the Red Sled performed exceptionally well on flat surfaces, but that the manufacturer did not specifically recommend it for use on stairs. Therefore, the Evaluators commented that they would not use this device for extricating victims up or down stairs if other options existed.

Use Multiple Devices. During the Hot Wash, most Evaluators recommended that responders consider using different type devices for different portions of the extrication. The suggested mission profile was to use one team with a drag type device within the building, transferring the victim to another team and an extrication chair to descend stairs, and a third team with another device to move the victim outside the building to the decontamination point.

Evaluator Responses - Medium Priority Criteria

Based on the Focus Group Medium Priority Criteria listed in paragraph 9.B. and the scoring data listed in Appendix C of this report, the medium priority scoring order is depicted in the table to the right. Discussion of the evaluation criteria not able to be evaluated or device anomalies are discussed in the paragraphs following.

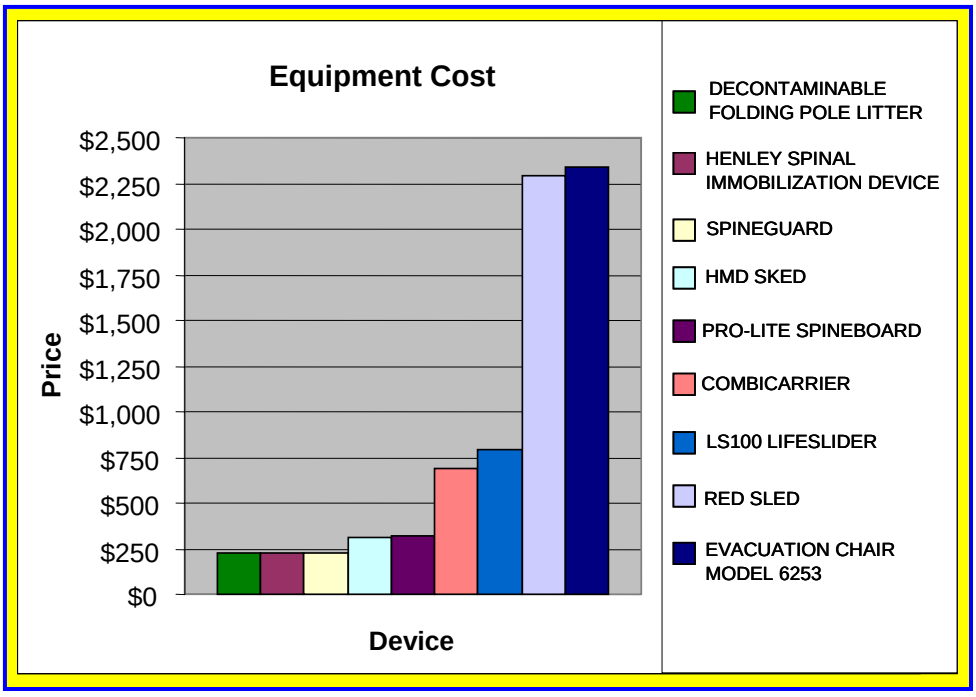
Medium Priority Scoring Order
Pro-Lite Spineboard®
HMD Sked®
Spineguard®
Evacuation Chair
CombiCarrier®
Henley Spinal Device
LifeSlider
Red Sled
Folding Pole Litter

CRITERIA

- Equipment Compatibility
- Cost
- Ease of Assembly
- Storage

Cost. Equipment cost was not factored in to the numerical scoring, but was listed as being of medium importance to the Focus Group Evaluation Criteria. Therefore, it is included in the criteria list above for completeness. The following chart illustrates the cost range among the extrication devices and is for informational purposes only:

Chart 11.1. Equipment Cost



As can be noted in Chart 11.1, the majority of devices cost between $200 and $300. Included in this majority are the Pro-Life Spineboard®, Decontaminable Folding Pole Litter, Henley Spinal Immobilization Device, Spineguard®, and the HAZMAT Decontaminable (HMD) SKED®. The

CombiCarrier® and LS100 LifeSlider are somewhat more expensive than the aforementioned devices, falling into a cost range of $600 to $800. The Red Sled and Evacuation Chair Model 6253 are much higher in cost than the other pieces of equipment involved in the assessment ranging in cost between $2200 and $2400.

The Pro-Lite Spineboard® was received without immobilization straps or a head immobilization restraint. Therefore, to configure the device similarly to the other extrication devices and to configure the board for moving patients safely down stairs, straps and head restraints were procured at an additional cost of $123.00. This raised the total comparative cost of the Pro-Lite Spineboard® to $324.00.

Cost vs. Usability. To address Question 9.3 of the Master Assessment List ("Is the device cost compatible with the device capabilities and usability?"), one could examine cost of the Evacuation Chair and the HMD SKED®. The Evacuation Chair Model 6253 costs approximately $2000 more than the HMD SKED®; however, according to results from the assessment, these two devices received extremely similar overall scores. This supports the hypothesis that cost may not be the principle or even a major factor in determining what to procure for extrication operations.

Storage Limitations. In reviewing the products examined in this assessment, there are no known limitations in storing these devices in normal responder operational environments, e.g., on vehicles or in equipment bays. Some strap materials may be more susceptible to damage from long term ultra-violet ray exposure, but this was not observed during this assessment.

Evaluator Responses - Low Priority Criteria

Based on the Focus Group Low Priority Criteria listed in paragraph 9.C above and the scoring data listed in Appendix C of this report, the scoring order was as depicted in the table at the right. Discussion of the evaluation criteria not able to be evaluated or any device anomalies are discussed in the paragraphs following.

Low Priority Scoring Order
HMD Sked®
Pro-Lite Spineboard®
Spineguard®
Evacuation Chair
Red Sled
Folding Pole Litter
CombiCarrier®
LifeSlider
Henley Spinal Device

CRITERIA

- Interagency Compatibility
- Sizability (Infant/Adult)
- Simple/Clear Instructions or Diagrams
- Recoverability
- Disposability

Disposability. Disposability was not specifically assessed during the RAVUE evaluation. However, the Evaluator consensus was that items taken into the WMD hot zone would not be expected to be cleaned and returned to service in the response organization. Items in the hot zone will likely be decontaminated as a practical safety measure, but the potential for product penetration into the extrication device materials including straps, buckles, hinges, and crevices, would prohibit the devices from being certified as safe for public use.

Construction materials and device dimensions may make disassembly or cutting-up more easily accomplished for the plastic or wooden devices than for those made of metal. Specialized and common over pack containers are available for virtually all of the devices assessed. However, obtaining and moving specialized or oversized packaging products could impose added burden on jurisdictions recovering from a WMD incident. For this reason, it is believed that items that can be easily cut up or that may be put in commonly available overpack containers have a disposability advantage over difficult to package products.

There were no known environmental, hazardous, or recoverable components or materials on any of the devices that would require special handling procedures.

12. OTHER DEVICE COMMENTS

A. EVALUATOR DEBRIEFING COMMENTS

When evaluators answered the debriefing questions, their comments generally addressed design characteristics when using the device in Level A PPE. Many comments were in the form of recommendations to manufacturers to further improve the designs of the devices. Comments were generally brief in nature without amplification. Additionally, not all evaluators cited the issues reflected in the summary tables.

Table 12.1. Straps and Buckles

Extrication Device	Evaluator Comments
CombiCarrier®	Secure straps to device instead of looping through handholds.
Evacuation Chair	Color code buckles.
Folding Pole Litter	No straps supplied.
Henley Spinal Device	Straps difficult in Level A. Need more instructions on straps and recommend a different buckle.
HMD Sked®	Make straps stiffer.
LifeSlider	Color Code buckles/straps. Add ring on strap ends.
Pro-Lite Spineboard®	Larger or stiffer straps and buckle, color code.
RED SLED	Larger tabs for straps.
Spineguard®	Change buckle to more universal style. Straps should be stationary.

Table 12.2. Handles, Wheels, and Locks

Extrication Device	Evaluator Comments
CombiCarrier®	Make handle smaller in diameter.
Evacuation Chair	Larger rear wheel for outside use.
Folding Pole Litter	Needs instructions on handles and smaller width handles.
Henley Spinal Device	Better handle placement.
HMD Sked®	No comments
LifeSlider	Larger rear handle.
Pro-Life Spineboard®	Larger width handles.
RED SLED	Better locks.
Spineguard®	Add additional handle on each side of head.

B. NOMINATED DEVICES NOT ASSESSED

In the Extrication Devices Market Survey Report and in the Assessment Plan, it was noted that two manufacturers nominated more than one extrication device for RAVUE assessment. However, because of resource limitations, the number of devices assessed was limited to one "top-of-the-line" nominated device from each of the nine manufacturers. The following paragraphs provide a snapshot of devices not assessed and potential performance under the RAVUE scenarios.

Henley Disaster Board, Model 1037. The board is approximately half the thickness of the assessed Model 1010, so there is potential for more board flexing. Hand hold locations were criticized on the Model 1010, and similar positioning issues would likely exist on the Model 1037.

Rapid Deployment Products, Pro-Lite PediLite®, Model 721. The PediLite is a 48" backboard designed for children. It would have been difficult to handle a 165 lbs mannequin with this device, even for short distances. Due to the hand hold placement and the size of the board, only two responders could use the device while wearing PPE.

Rapid Deployment Products, Pro-Lite Spineboard®, Models 717 and 719. Informal research of the attributes and capabilities of Models 716, 717, & 719 indicated that all are similar in design and function. Differences principally include the construction materials, reinforcement of hand holds, and the degree of translucency under x-ray. Models 717 and 719 are expected to perform similarly to the Model 716 under RAVUE conditions.

Rapid Deployment Products, Multi-Purpose Carrier, Model 722. This product is somewhat different from all of the RAVUE carry and drag type devices assessed in that it is a nesting type device with short sides and full circumference hand grip points. However, at 33 lbs, it is approximately 13 lbs heavier than the other backboard devices. The weight might have been mitigated in the scenarios presented, in that it could have been moved by two or more Evaluators. Given the success of the other RAVUE drag devices, and presuming that this device would have held up to the conditions imposed, the evaluators would likely have scored the device high in their assessment.

13. COMPARATIVE ASSESSMENT CONCLUSIONS

All of the extrication devices used in this assessment performed up to the manufacturer's advertised capabilities of the manufactures within the scenarios presented in the RAVUE assessment. No false or extravagant claims were noted. Additionally, all of the devices were able to be successfully used by the responders wearing Level A PPE. Therefore, all nine of the devices would be useful in extricating victims from a WMD mass casualty incident.

It is interesting to note that the two devices that scored the highest by the Evaluators in the high priority criteria included one of the least expensive and the most expensive items. This tends to indicate that cost is not a good indicator of relative merits of the extrication devices, especially for the scenarios used in this assessment.

Assessment Summary

The Extrication Chair received the highest rating in the High Priority Criteria. For a jurisdiction that conducts frequent patient extrications from multi-story buildings, the extrication chair would prove valuable in day-to-day operations. However, in the mass casualty scenario represented in the RAVUE assessment, the evaluators gave the SKED® high marks in every Evaluation Criteria Category.

SKED®	
High Priority Criteria	#2
Medium Priority Criteria	#2
Low Priority Criteria	#1

Most scenarios presented in this assessment involved traversing at least fifteen stairs. This resulted in several comments after the assessment, that devices such as the Red Sled were not advertised by their manufacturer as being designed for stair extrications. Thus, using this device in scenarios that required at least some use on stairs might be a misapplication of the devices many other attributes. Consequently, the Evaluators recommended that a combination of extrication devices might best contribute to a mass casualty situation generally tailored to the environment in which the extrications would occur. The example cited was using the Red Sled for movement within a structure with reasonable flat surfaces, transferring the victim to a stair chair for movement down flights of stairs, and then to a drag, roll or carry device for movement outside the building.

Lastly, the single area that Evaluators believed that manufacturers might quickly improve upon is strap color coding and restraining strap configuration. Black straps with black buckles are near invisible when attempting to buckle them while wearing black protective gloves molded into the Level A suites. This is further complicated when operating under dimly lit conditions and looking through a fogged up facepiece. Also the material used in the straps is important when considering ease of decontamination.

14. LIST OF APPENDICES

Appendix A - Assessment Questions
Appendix B - Evaluator Debriefing Worksheet
Appendix C - Device Tabulations

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